agricultural research

U.S. DEPARTMENT OF AGRICULTURE FEBRUARY 1977

February 1977/Vol. 25, No. 8

Gardener's Reveries

As wintry nights close in, fires crackle in tune with the rustle of pages filled with glowing promises and magnificent photos. Gardeners everywhere are poring over catalogs, savoring hundreds of enticing horticultural offerings while patiently waiting for the pallid earth to green anew. It is again time to make plans and order seeds for the growing year.

But if seed catalogs are designed to provoke activity, they also bestir reveries, for gardening by its very nature has a contemplative side. There is time not only for work, but also for reflection and the making of memories as garden life pulses to the mystery of green, sometimes pressing on, sometimes pausing in response to the rhythms of the seasons. As every gardener knows, paging through a seed catalog can be most evocative of gardens past.

The gardener works with the basics: life-harboring seeds that fulfill their eternal promise to yield fruits, vegetables, and flowers—gifts to nourish our bodies and souls. At seed time, especially, he feels an instinctive kinship with forebears whose lives once meshed with the great cycles of nature. Modern man, unfortunately, has largely lost touch with elemental realities.

Modern man needs to preserve his connections with his ancestral past. Although man throngs the cities he still moves to ancient rhythms. Indeed, the weekly exodus to the country basically reflects a biological need to maintain contact with the kind of environment from which we evolved. It is a need well met by contact with the world of growing things.

Gardening fosters another benefit. In our increasingly rootless urban society, gardening can help instill a much needed sense of place. This can come from caring for one's own piece of earth, whether far-flung acres or the humblest of garden plots. When we cherish our gardens, we are really caring for the countryside around us, a commitment that underlies the development of an ecological conscience.

Today's emphasis on ecology is a healthy one. More people need to know that we live because of plants. It is the green leaf, powered by sunlight, that through photosynthesis turns carbon dioxide and water into the oxygen and sugars that ultimately sustain all life. In our urbanized society, gardening can help us appreciate this fundamental truth.

Gardening offers many values to enrich man's inner and intangible being. The contemplative gardener finds some of them in the rustle of the catalog's pages as he awaits the rewards that mount with a warming sun.—*R.P.K.*

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COVER: "Big Muskie," the largest dragline in operation in the world—capacity 220 cubic yards—will be used for final removal of the deeper overburden in Ohio watershed-strip mining study (0476X343–26). Article begins on page 3.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service (ARS), U.S. Department of Agriculture, Washington, D.C. 20250. The Secretary of Agriculture has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 15, 1977. Yearly subscription rate is $6.50 in the United States and countries of the Postal Union, $8.15 elsewhere. Single copies are 55 cents domestic, 70 cents foreign. Send subscription orders to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Information in this magazine is public property and may be reprinted without permission. Prints of photos are available to mass media; please order by photo number.

Talcott W. Edminster, Administrator
Agricultural Research Service

Pictured above is one of the watersheds to be mined. It is associated with Middle Kittanning (No. 6) coal in Coshocton County, Ohio. It covers approximately 51 acres and already has sediment and flow-measuring devices in place (0476X342–4).

Watersheds and Strip Mining

WHAT happens to a watershed after it has been strip mined? Surprisingly little information is available now, says W. Russell Hamon, location leader at the North Appalachian Experimental Watershed (Box 478, Coshocton, OH 43812). To close this information gap, he is leading a 5-year study on the effects of strip mining on four watersheds while monitoring a benchmark watershed from which ARS has collected 35 years of hydrologic data.

"We are already obtaining information on the watersheds so we can compare hydrologic parameters such as runoff before and after strip mining. We will look at total runoff, erosion, ground water storage, water quality, and pollution-causing materials such as silt and acid," Mr. Hamon said.

"Because of the prospects of greatly increased coal production, we need all the information we can collect to properly assess the problems of reclamation of mined lands, and to define the occurrence and movement of water, changes in water quality, and soil erosion problems. These research findings will be useful in the design of sediment dams and erosion control structures and in the evaluation of different materials and crops for covering mine spoils," Mr. Hamon said.

Left: U.S. Geological Survey hydrologist Alan C. Sedam examines a piece of core sample taken from one of the watersheds. The samples aid in locating ground water observation wells, which will be used to analyze water quality and movement (0476X344–30).

Below: V-notch weirs are installed at the base of the watersheds to determine streamflow. Water samples are also taken from each location. Hydrologist James V. Bonta checks instrumentation that records streamflow data (0476X346–8).

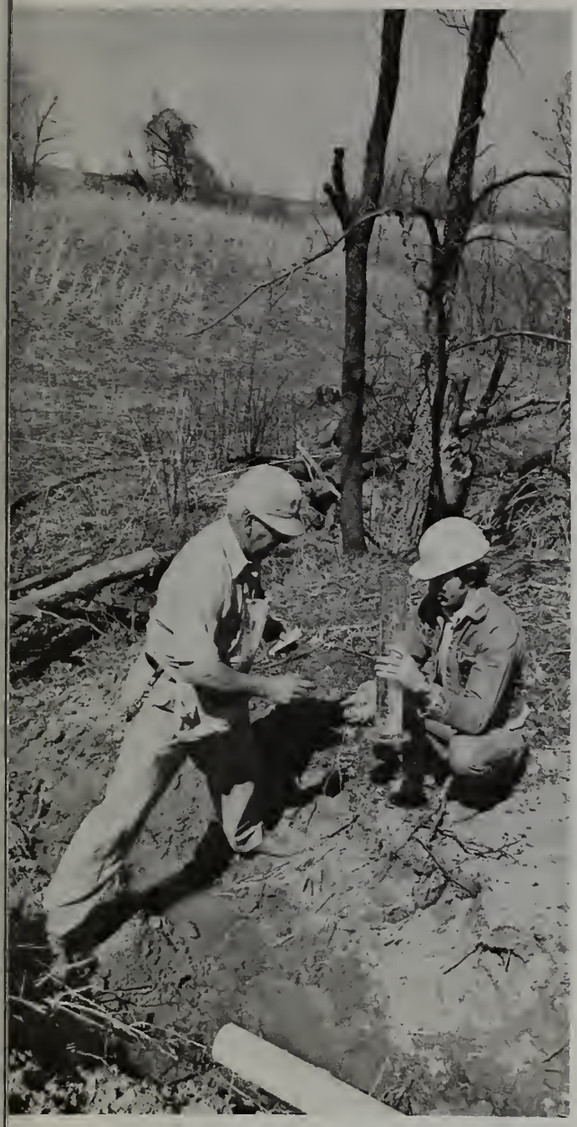
Below: To determine surface and subsurface water movement, hydrologic technician Harold E. Frank takes soil moisture readings, using a neutron probe (0476X342–9).

"The information will also be of use to agencies, legislative and regulatory bodies, and commercial companies in developing and complying with regulations. It will assist the mining and regulatory agencies in assessing the environmental impacts before mining and in economical and effective reclamation after mining."

The five watersheds, each about 50 acres, are in Coshocton, Muskingum, and Jefferson Counties. Hydrologic and water-quality data are being obtained now and will be collected during and after surface mining operations. The benchmark watershed, which will not be mined, is being monitored for comparison.

The cooperative study is funded by grants totaling $2,355,000 from the U.S. Bureau of Mines. Cooperators include ARS, the Ohio Agricultural Research and Development Center, the U.S. Geological Survey, the Soil Conservation Service, the Muskingum Watershed Conservancy District, and three mining companies.

ARS has installed watershed instrumentation and is measuring surface and spring waterflow, erosion, precipitation, soil water, and meteorological conditions, as well as collecting water samples. Data obtained by ARS and the various cooperators will be consolidated. Using these data as a benchmark, procedures will then be developed to estimate the flow of surface water both before and after mining, as well as the changes that may be expected in water quality due to mining.



Left: *Soils technician Clifford I. Olinger and engineering technician David R. Gallwitz measure flow from a developed spring in an area of Meigs Creek (No. 9) coal in Muskingum County, Ohio. Spring flow and water quality are determined before mining. These data will be compared with measurements taken after the area is mined (0476X343–7).* ***Above:*** *This V-notch weir will be used to monitor runoff and water quality. Here, linseed oil is applied to the surface of the fresh concrete to slow down the curing process. This increases the strength of the concrete and prevents surface flaking and scaling (0476X342–29).* ***Below:*** *Windspeed and other meteorological data will be used to estimate evapotranspiration from the study area. Mr. Gallwitz records data from an anemometer (0476X347–13).*

The Ohio Agricultural Research and Development Center, Wooster, will analyze water quality, determine chemical and physical characteristics of soils and overburden materials, and study the effects of various management practices on surface water quality. They will also study the relationships of costs and benefits under various possible strip mine regulations and pollution-control rules.

The U.S. Geological Survey will obtain geologic cores from the watersheds, measure water levels in observation wells, and collect samples from wells and springs for chemical analyses. They will develop ground water flow models to simulate quantity of flow and water quality before and after mining.—*R.G.P.*

Mr. Pierce, using a laboratory padder, applies the treating solution to a piece of test fabric. The solution contains the cross-linking agent and the catalyst (1076X1278–11).

Triple-threat Catalysts

SCIENTISTS have developed three new triple-threat bisulfate catalysts that show real promise for use in applying durable-press finishes to all-cotton and cotton-polyester fabrics.

All three catalysts are free from heavy metals which pollute streams, are free from halides which can form a cancer-causing compound, and are very active thereby offering means of conserving energy.

After a study of several catalysts that were considered potential alternatives to the currently used zinc nitrate (a heavy metal salt) and magnesium chloride (a halide salt), the scientists found the most promising catalysts to be the bisulfate salts of the light metals, sodium, magnesium, and aluminum.

ARS chemists Andrew G. Pierce, Jr., Robert M. Reinhardt, and Russell M. H. Kullman of the Southern Regional Research Center (P.O. Box 19687, New Orleans, LA 70179), point out that, like other segments of our society, the textile-finishing industry is being influenced by a growing interest in ecology and the need for energy conservation.

In certain areas of the country authorities have either banned or seriously restricted the use of zinc nitrate and other heavy metal salts because their presence in plant effluents pollutes streams. Moreover, many textile finishers have found that nitrate-containing catalysts can cause shade changes in certain dyes and yellowing on some white goods.

During the past few years, scientists at the SRRC have been conducting a dual-purpose study of the catalysis of chemical reactions used to impart durable-press characteristics to cotton and cotton-polyester fabrics. The first objective was to thoroughly investigate the chemistry of catalytic activity, and the second was to use the information obtained to aid in the selection and development of practical alternative catalysts that would be as

Before the treating solution is applied, the fabric is marked to size, using a template, and cut to fit a frame (1076X1278–3).

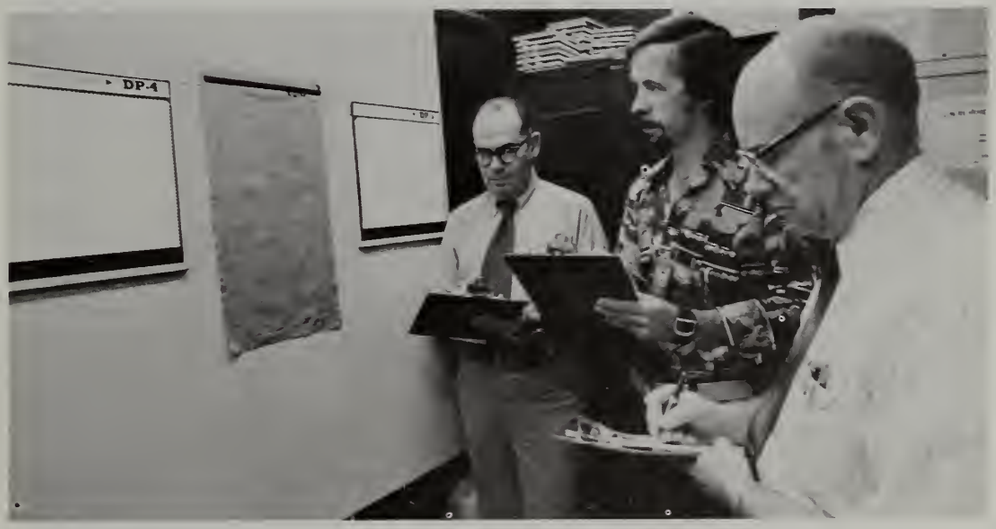
tent that at least one supplier is already offering a sodium bisulfate catalyst to finishers.

In evaluating the catalysts, fabric samples were given durable-press treatments using a wide variety of the industry's chemical formulations with the experimental catalysts. Results were favorable in all ways.

Durable-press appearance ratings of 4 or better were attained on a scale of 1 to 5. Heavy metals were eliminated. Catalyst cost was way down. No color changes in either dyed goods or white goods were observed.

Energy conservation is of real interest to the textile-finishing industry because the chemical reaction between the cotton and the chemical finishing agent occurs in the presence of heat. The fabrics, once wetted with the chemical solution, are run through an oven for "curing." The new catalysts are highly effective even when the curing time is reduced from 3 minutes to as little as 30 seconds.—*V.R.B.*

The test fabric is pinned to the frame to prevent shrinkage or stretching during testing (1076X1279–10A).



After the test material is treated and dried, Mr. Reinhardt, Mr. Pierce, and Mr. Kullman rate it against known appearance standards. A rating scale of 1 to 5 is used, in which 1 represents the appearance of untreated cotton after washing and tumble drying and 5 represents that of ironed cotton (1076X1277–6A).

good as or better than present catalysts, all without the three problems—halide, heavy metal, or the use of large amounts of energy.

Of the three bisulfate catalysts, the most promising appears to be sodium bisulfate. It appears particularly attractive because its catalytic activity is greater than that of either zinc nitrate or magnesium chloride. Moreover, its potential cost in use is substantially less than either of these conventional catalysts, only about one-tenth as much as zinc nitrate.

This research into catalysts has been of real interest to the textile-finishing industry and to its suppliers to the ex-

Below: Mr. Hawkes inspects larval development of Coleophora parthenica, *a Pakistani moth, in an infested Russian-thistle plant (0976X1080–01). Right: California spends more than $500,000 a year to rid highway rights-of-way of Russian-thistle. Still the weed prospers, as seen along this stretch of California's Interstate 5 (0976X1081–14).*

Biological Control of Russia

RUSSIAN-THISTLE—tumbleweeds—and halogeton, a weed toxic to some livestock, are targeted for biological control programs and one day may be "grazed" to manageable levels by a small, white Pakistani moth.

The moth, with a name longer than it is, *Coleophora parthenica*, has been under study for several years by ARS. Entomologist Robert B. Hawkes has corresponded with entomologists in Egypt, visited Pakistan, and spent years of research on the insect here at home to determine that the moth attacks only Russian-thistle and halogeton. It is the natural enemy of the weeds in Asia and parts of Africa, and scientists have little fear of it attacking anything but the specific host plants for which it is being imported.

Although tumbleweeds and halogeton are attacked by a large number of insects in this country, there are no specific natural enemies capable of controlling the plants. They were introduced here accidentally—the thistles about 1873 in South Dakota and halogeton sometime before 1935 in Nevada.

Since its introduction, Russian-thistle has invaded most parts of the country, particularly the Western States and parts of the Central States and is now spreading along the southern and eastern coasts. Halogeton has taken over nearly 10 million acres of western rangelands. Sheep particularly are affected by halogeton.

A single Russian-thistle plant produces 20,000 to 50,000 seeds. When it matures, it breaks off at the soil surface and blows with the wind, scattering seeds along the way. Halogeton seed is spread by wind, animals, and man's vehicular traffic.

Scientists are concentrating their efforts on establishing the moth on Russian-thistle. Field releases of moths reared from overwintering larvae collected in Pakistan have been made in California, Nevada, Utah, Idaho, and Arizona.

The insect is now well established at several sites in California: near Kettleman City and Indio it has built up population levels that are exerting some control of the plant. There the moth populations are high enough to allow entomologists under the direction of ARS to distribute the insects by "relocating" tumbleweed to other sites.

The moth is also established at one site in Nevada; however, populations remain low. It apparently did not become established at either the Idaho or Utah site. The two sites in Arizona, near Tucson and Phoenix, have only recently been "seeded" with live moths.

One obstacle to the ready establishment of the moth is the scattering by the wind of tumbleweeds containing the overwintering larvae. Small initial colonies become too widely dispersed to allow the newly emerged moths to readily find mates.

Eventually, however, the plant's tumbling habit should aid in spreading the moths.

In Pakistan, the moths help control the thistle, keeping it to a much smaller size and fewer numbers than are found in this country. In areas infested with *Coleophora parthenica* in Pakistan, the plants get slightly larger than 12 inches

n-thistle

in diameter. Plants sometimes reach a diameter of 3 to 7 feet in the United States.

Mr. Hawkes believes that if the moth is established here, it may keep the plant smaller, reduce its number, or even kill it outright. The moth—like the weeds—has no known natural enemies in the United States, which may give it a much better chance of reaching larger populations than in areas where it is suppressed by its own predators.

Eggs of the female moth are laid singly on the leaves of Russian-thistle, and the newly hatching larvae feed directly through the eggshell and into the leaf. The larvae are never exposed to the external environment.

After feeding a few days inside the leaves, the larvae move to the stems of the plant and complete their development. The larvae feed for a time, cut a small porthole to the outside, and pupate inside the stems of the Russian-thistle. Upon emerging from pupation, the moth exits via the porthole, mates, and starts the cycle over again.

Pakistani moth, C. parthenica, *on Russian-thistle stem. The moths lay their eggs singly on stems and leaves near terminal ends of new growth (0976X1085–11A).*

Feeding larva of C. parthenica *is shown in this cutaway section of a Russian-thistle stem. The larva will feed for a time, cut a small porthole to the outside, and pupate inside the stem. Upon emerging from pupation, the moth exits through the porthole, mates, and starts the cycle again (PN–4123).*

Russian Thistle

Russian-thistle plants infested with larvae and pupae of the tiny Pakistani moth are harvested by Mr. Hawkes (left) and agricultural technician Aubrey Mayfield. The plants will be taken to new sites where the emerging moth will infest the weed (0976X1079–31).

There are three generations of moths during the summer in Pakistan, with the last-instar larvae of the third generation entering diapause and passing the winter in that state.

Tests show that adults offer no problem to native flora—they do not feed. In most cases in the laboratory, females laid eggs on Russian-thistle alone. When eggs were laid on other plants, the egg developed but the larva seldom left the egg—just remained inside and died. Occasionally larvae emerged but lived only a short time in plants other than Russian-thistle.

Since the larvae are not able to crawl, except within the confines of a self-made tunnel, larval movement from one plant to another is just about impossible.

With the moth being found over a wide area—Algeria, Egypt, Turkey, Pakistan, South Central Russia, and Iran—the wide distribution would offer a number of climates from which to select ecotypes for introduction into various climatic areas of the United States.

Russian-thistle is a favored alternate host of the sugar beet leafhopper, vector of the destructive "curly top" virus of beets, tomatoes, melons, etc.

In addition, the tumbleweeds fill irrigation and drainage canals, pile up against fences and buildings, fill backyards and swimming pools, and cause highway accidents. The California Highway Department, which along with the California Department of Agriculture partially funded the study, spends more than $500,000 a year to get rid of the thistles along highway rights-of-way. Unsightly accumulations of the dead, dry plants are not only difficult to remove, but also create fire hazards and traps for other windblown debris.

C. parthenica *has been released in this lush stand of Russian-thistle near Bakersfield. To determine the rate of larval infestation and the amount of damage to the thistle plants, this site will be regularly monitored by Mr. Hawkes, economic entomologist Richard L. Dunkle of the Biological Control Services, California Department of Food and Agriculture, and Mr. Mayfield (0976X1079–35).*

Most of the "cost" of halogeton is millions of acres of rangeland that are useless for grazing sheep. Cattle, for the most part, are not affected by the weed's toxicity, but they graze it only when nothing else is available. Sheep, however, die when they eat the weed. It has been reported that flocks numbering up to 1,200 head have been wiped out after grazing halogeton.

Mr. Hawkes, Biological Control of Weeds Laboratory (1050 San Pablo Ave., Albany, CA 97406), says that "an immediate goal of this project is to establish strong field colonies of the moth at selected locations."

The California Agricultural Experiment Station is cooperating in the study.—*J.P.D.*

Small Reservoir Cleans Runoff

STORM RUNOFF inevitably carries soil particles and plant nutrients into rivers and lakes, despite farmers' efforts to conserve these resources. But sedimentation and pollution in major bodies of water may be reduced by cleaning up the runoff water with small reservoirs before it moves very far.

In a 3-year study, agricultural engineer David L. Rausch, ARS Watershed Research Unit (207 Business Loop, 70 East, Columbia, MO 65201), found that a small flood-detention reservoir trapped 87 percent of the sediment, 71 percent of the phosphorus, and 37 percent of the inorganic nitrogen which entered it. The central Missouri reservoir had a capacity for storing 0.39 of an inch of runoff from its 5½-square-mile drainage area.

The percentages of sediment and phosphorus that are trapped in reservoirs during storms are related to rainfall characteristics and soil conditions in the watersheds, Mr. Rausch says. As these watershed conditions change, peak rates of runoff as well as concentration and particle sizes of the sediment also change.

Water which flowed from the reservoir contained suspended particles of fine clay with attached phosphorus. Average concentrations of phosphorus on these clay particles were twice as great as concentrations on incoming sediment.—*G.B.H.*

Chlorine May Aid Irrigators

URBAN GARDENERS and other persons with drip or subsurface irrigation systems using chlorinated city water may have a good thing going.

In drip irrigation, small amounts of water are metered to individual plants or trees by individual emitters—tiny "nozzles"—daily instead of large amounts weekly. Subsurface irrigation uses lines buried beneath the surface to meter small amounts of water to the root zones of crops or lawns.

Clogged lines and emitters are often a problem with drip and subsurface irrigation systems. Chlorine is promising for controlling emitter clogging caused by bacterial growth. At least one manufacturer recommends chlorine treatment to restore flow rates diminished by biological reactions.

Agricultural producers have the means of adding chlorine to irrigation systems if they desire. Gardeners and lawn enthusiasts using drip or subsurface lines may, however, find it impractical to own equipment to add the chemical to their water.

A recent study by ARS technician Kenneth R. Davis (University of California, Soil Science and Agricultural Engineering Dept., Riverside, CA 92502), indicates that irrigators using city water may not have to be concerned about adding chlorine since most city water contains about 0.2 or more parts per million (p/m) chlorine.

Mr. Davis, in a field study, used waters with three different chlorine contents—0.0, 0.2, and 0.9 p/m—in three different subsurface irrigation lines. The lines were a dual-chambered perforated plastic tubing; a relatively new, single-wall, perforated rubber tubing; and a porous plastic tubing.

He placed the lines beneath rows of potatoes in the study to compare the effectiveness of chlorine on water flow rates and performance of the irrigation tubing.

The short-term study revealed that chlorine was effective in preventing clogging and maintaining higher flow rates in the two plastic tubing subsurface applicators and that the 0.2 p/m rate was as effective as 0.9 p/m. With the third applicator, the rubber tubing. clogging was apparently not a problem because a stretching action made it self-cleaning. Potato yield in this short-term study was not affected by the small amount of chlorine.

While Mr. Davis' study was concerned with subsurface irrigation lines, he said that the chlorine in city water should aid in keeping above-ground drip irrigation emitters also fairly clear of bacteria.

Mr. Davis cautions that biological growth is only one type of clogging. Other types of clogging include chemical, physical, and a combination of all three.—*J.P.D.*

Above: Semen from a drone is drawn into a collection syringe (1076X1271–5). ***Right:*** *Biological technician Mary S. Toaston collects semen from an adult drone, using an instrumental insemination apparatus. The apparatus makes possible the collection of specific amounts of semen from either an individual drone or the entire drone population of a colony (1076X1274–18).*

Storing Honey Bee

PROGENY have been produced from honey bee sperm stored in liquid nitrogen (−320° F). For ARS scientists, this storage capability may lead to a greatly expanded inventory of breeding stock.

Liquid nitrogen is a long-term storage medium used for semen from cattle, humans, and a few other animals. Cattle semen has been stored in liquid nitrogen for as long as the technique has been used—about 20 years.

Entomologist John R. Harbo of the Bee Breeding and Stock Center Laboratory (Route 3, Box 82–B, Ben Hur Rd., Baton Rouge, LA 70808), reports storing bee spermatozoa in liquid nitrogen for 48 hours.

"Forty-eight hours is not a long storage duration," says Dr. Harbo. "Well-established storage techniques at non-freezing temperatures are more practical when storing semen for only 48 hours. But the 48-hour storage in liquid nitrogen is significant because it shows that bee spermatozoa can survive the harsh transition into and out

Sperm

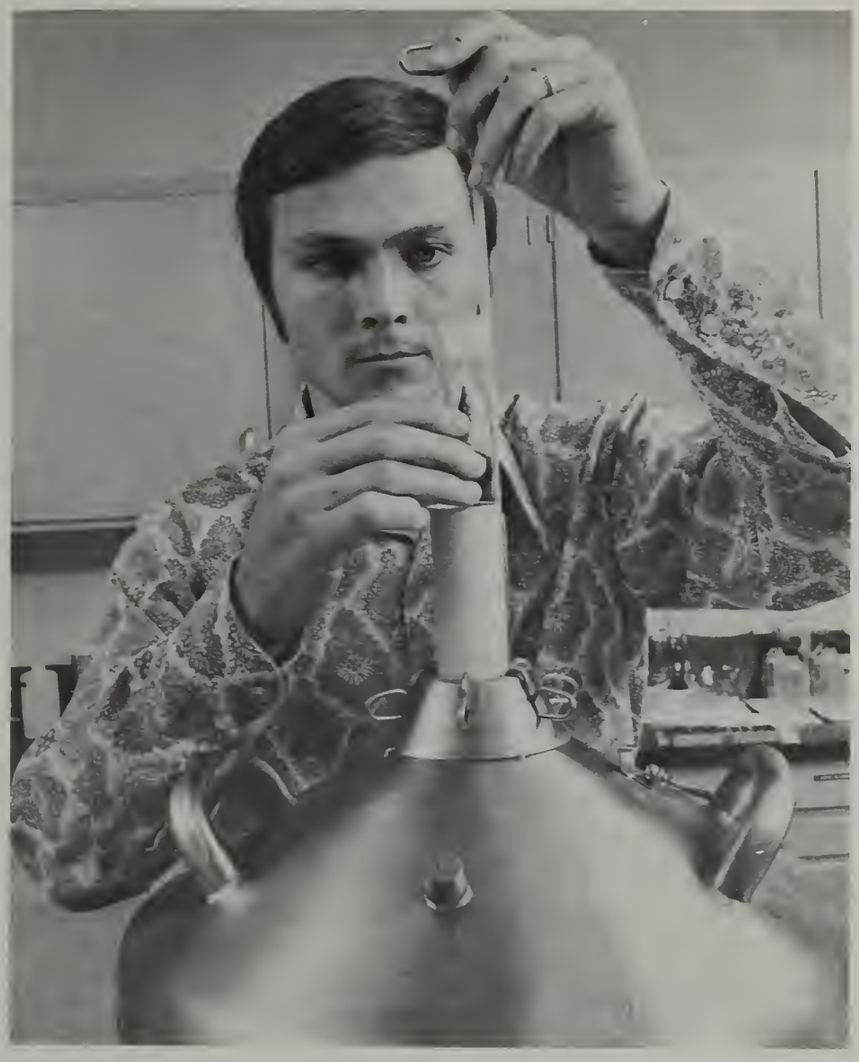
of extreme cold. Hopefully, bee sperm, like cattle sperm, can survive in liquid nitrogen for many years as easily as it can for 48 hours; only time will tell."

The key to success was the chemical DMSO (dimethylsulfoxide). DMSO somehow protects the sperm cells from the extreme cold.

Eye markers were used to prove the progeny came from the frozen sperm. Virgin queens carrying the eye marker gene, snow, were inseminated with previously frozen semen from drones with tan eyes.

Worker and queen progeny with red eyes indicated that these bees had inherited the snow gene from their mother and the tan gene from the frozen sperm.

If storage for 2 years or more is successful, laboratory labor for propagating and maintaining live colonies will be replaced in part by sperm storage and recordkeeping, thus reducing operating costs and permitting a great increase in the storage capabilities at the laboratory.—*P.L.G.*



Above: *Dr. Harbo places recently collected semen in a tank of liquid nitrogen for storage. Each tube is marked with collection data to facilitate identification and recovery (1076X1271–22).*

Left: *After the semen has been collected and stored, its viability is tested by inseminating a queen bee. A syringe is alined with the reproductive tract of the queen—as she is held in a plastic tube—and the semen introduced (1076X1273–16).*

Protein Content Counts

When it comes to protein supplements for lambs, dehydrated poultry excreta may equal the old standby, alfalfa. In fact, poultry excreta is superior to alfalfa in its crude protein, calcium, and phosphorus content and may one day be preferred over other protein sources for ruminants.

In tests at Beltsville, scientists found that lambs fed dehydrated poultry excreta as a crude protein source grew as fast as and tended to be more efficient than lambs fed alfalfa as the crude protein source.

ARS animal scientist Lewis W. Smith working with chemist Ivan L. Lindahl (Building 200, Beltsville Agricultural Research Center—East, Beltsville, MD 20705), used 20 lambs in each of two feeding trials.

Each trial consisted of four diets: one each with the alfalfa to provide 8 and 12 percent dietary crude protein and one each with dehydrated poultry excreta to provide 8 and 12 percent dietary crude protein. The protein supplements contributed 38 percent of the total dietary nitrogen (TDN) in the 8-percent crude protein diets and 62 percent of the TDN in the 12-percent crude protein diets. All diets contained 65 percent TDN.

Poultry excreta was collected from caged laying hens and was free of drugs and additives. The excreta was either dried in a rotary-drum dehydrator or processed by drying in vibrating trays in a stream of hot air. Cornmeal, corncobs, and salt were mixed with the protein supplements, and the feed was pelleted. Lambs were fed free-choice for 45 days.

Lambs fed the dehydrated poultry excreta as the crude protein source consumed more feed and tended to be more efficient in converting feed to weight gain than lambs fed the alfalfa-supplemented diets. The cost per pound of gain was 17 percent less for lambs fed the dehydrated poultry excreta.

Lambs fed poultry excreta at the 12-percent crude protein level consumed 22 percent more feed, gained 74 percent faster, and were 39 percent more efficient in converting feed to gain than lambs on the 8-percent crude protein diets.

The Food and Drug Administration has not approved dehydrated poultry manure as a feed for sheep.—*M.E.N.*

Protein Supplement for Lambs

Protein content, but not percentage of dark hard kernels, is a consistent index of breadmaking quality in wheat.

Wheat with a high percentage of yellow hard kernels, commonly known as yellow berry, usually tests lower in protein than wheat with a high percentage of dark hard kernels. Protein content rather than kernel color indicates suitability of wheat for breadmaking, says ARS chemist Y. Pomeranz.

Dr. Pomeranz led a study of functional properties of dark hard and yellow hard winter wheat at the U.S. Grain Marketing Research Center (1515 College Ave., Manhattan, KS 66502).

The study was a part of a continuing effort by ARS to improve objective methods that are used for measuring economically important properties of hard wheats.

A higher than normal amount of yellow berry was reported in 1975 wheat grown in parts of Oklahoma, Kansas, and Montana. Inadequate soil nitrogen, variety, maturity, and climate may all influence the proportion of yellow kernels. Wheat with less than 75 percent dark hard kernels is subject to price discounts when marketed.

The researchers compared 1975 crop commercial wheat samples ranging from 10.4 to 14.5 percent protein and from 11 to 82 percent dark hard kernels. All samples were satisfactory in flour yield, which was not consistently affected by percentage of dark kernels or protein content.

In baking tests, about 96 percent of the variability in loaf volume was related to protein level of wheat or flour, Dr. Pomeranz found. Small differences in proportion of dark hard kernels had little effect on water absorption or loaf volume unless these differences were accompanied by variations in protein.

In a concurrent study with 1975 Centurk and Buckskin wheat grown in western and central Kansas, the researchers also compared breadmaking qualities of separated dark kernels, yellow kernels, and unseparated samples.

The yellow kernels averaged less protein than dark kernels or unseparated samples. Yellow kernels also had lower baking absorption, required longer mixing times, and produced smaller loaves of bread. Dr. Pomeranz says, however, that the poorer breadmaking qualities of the yellow kernels were a result of differences in protein.—*W.W.M.*

AGRISEARCH NOTES

Frozen sugarcane recovers

IT is widely believed that freeze damage to sugarcane is irreversible. In the first known evidence to contradict this, scientists have found that partially frozen sugarcane stalks, although suffering damage, can recover and appear visually normal.

Plant physiologist James E. Irvine and agronomist Benjamin L. Legendre at the U.S. Sugarcane Laboratory (P.O. Box 470, Houma, LA 70360), observed damage in standing-mill cane immediately after thawing and 10 or more days later. Tissue damage followed successive natural freezes at minimum temperatures of 25° and 24° F on December 19, 1974, and January 9, 1976, respectively.

"Damage observed just after thawing was more extensive than damage observed later, indicating vitality," said Dr. Irvine. "We found this to be true after both freezes."

Two tests were made of sugarcane varieties, one with an intact canopy and one in which the canopy had been opened before the freeze. The canopy is made up of the leaves which form a tentlike cover over the mature cane growing in rows in the field. When this canopy is broken by lodging or cutting, the canopy is less protective.

Deterioration was less in the test with the intact canopy; varieties N Co 310 and CP 65–357 were superior in keeping quality. In the open canopy test, varieties CP 48–103 and CP 65–357 were superior and CP 52–68 and CP 61–37 were inferior in keeping quality.

Deterioration in standing cane was compared with frozen tissue sampled on the last sampling date. The amount of frozen tissue indicated increases in dextran soluble polysaccharides and titratable acidity, and decreases in starch, sucrose, and purity.—*P.L.G.*

Bean yield triples in sludge

ADDING 200 tons of sludge per acre annually tripled snap bean yields on some plots without significantly increasing heavy metal uptake.

Three years of application of anaerobically digested sludge at three annual rates—50, 100, and 200 tons—were compared as were conventionally fertilized plots. The primary objective of the project was to evaluate heavy metal uptake by snap beans, says soil scientist Robert H. Dowdy (Soil Science Building, University of Minnesota, St. Paul, MN 55108).

Bean tissue grown on the plots with highest sludge applications showed 45 parts per million (p/m) of zinc in the first year of the experiment compared with 36 p/m in samples from the control plots. Three years of 200-tons-per-acre applications failed to increase the zinc content of the beans beyond the 58 p/m level.

Cadmium content of the bean tissue also was not changed appreciably by addition of sludge.

In the first year, copper content increased from 6 p/m in beans from the control plots to 10 p/m from beans grown on the sludge plots but did not increase with the annual addition of sludge, Dr. Dowdy said.

Working with Dr. Dowdy on the cooperative project were ARS soil scientist William E. Larson and University of Minnesota soil scientists Jane M. Titrud and Joe J. Latterell.—*R.G.P.*

TGE transmitted by nursing sows

NURSING SOWS which are infected with transmissible gastroenteritis (TGE) can readily spread the virus to their susceptible litters.

"Our finding that TGE virus is present in the milk of sows some time after infection may help explain the speed with which infection spreads among their pigs," says ARS veterinary medical officer Lorant J. Kemeny, National Animal Disease Center (P.O. Box 70, Ames, IA 50010).

Dr. Kemeny and microbiologist Roger D. Woods experimentally exposed 11 sows to virulent TGE virus within 5 days after farrowing. The sows, initially free of antibodies against the virus, all showed signs of clinical TGE infection. The researchers recovered the virus from the sow's milk for 5 to 6 days after exposure, as well as from nasal secretions and feces.

All 43 pigs in 5 of the litters that nursed experimentally infected sows developed signs of TGE, and 29 pigs died in 2 to 9 days. Of 40 orphan pigs separately fed the milk from the other 6 sows, 19 developed diarrhea in 24 to 40 hours, and the researchers isolated TGE virus from them at post mortem examination.

Dr. Kemeny says exposure by injection of the virus into the udder, used in some tests, showed that the sow's mammary gland cells are highly susceptible and able to produce large amounts of virus. TGE virus may infect the udder when the sow is lactating, he explains, and then be directly excreted into the milk—presumably under natural as well as experimental conditions.—*W.W.M.*

UNITED STATES GOVERNMENT PRINTING OFFICE
PUBLIC DOCUMENTS DEPARTMENT, WASHINGTON, D.C. 20402

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UNITED STATES DEPARTMENT OF AGRICULTURE
AGR 101

AGRISEARCH NOTES

"Sweet Sue" Impatiens

NEW GUINEA IMPATIENS species and cultivars collected by ARS plant scientists in 1970 created much interest among plant breeders and gardeners in this country after their release in 1972. New and exciting hybrids were predicted.

"Sweet Sue," the 1976 introduction into the world of impatiens by the Ornamentals Laboratory, BARC (Beltsville Agricultural Research Center, Beltsville, MD 20705), is the first hybrid from the New Guinea germplasm both to reproduce true from seed and to bear flowers year round in the greenhouse.

ARS horticulturist Toru Arisumi led the breeding program at BARC which produced "Sweet Sue."

Dr. Arisumi derived the new cultivar from colchicine treatment of a sterile hybrid, a cross between a New Guinea hybrid seedling and "Tangerine," a cultivar from Celebes, Indonesia. "Sweet Sue" is a fertile amphidiploid (double diploid, two sets of each parent's chromosomes).

"Sweet Sue" is slightly more tolerant of heat than other impatiens. It also has large orange flowers (2 inches in diameter) and slightly variegated leaves.

There has been progress in the practical aspects of breeding and growing the New Guinea impatiens, but, according to Dr. Arisumi, much is still unknown about their genetics, cytology, and morphology.

Joseph J. Higgins, formerly a plant physiologist with ARS and now working as a plant variety protection examiner for USDA's Agricultural Marketing Service, and ARS horticulturist Harold F. Winters of BARC's Germplasm Resources Laboratory led the 1970 expedition to New Guinea.—*S.B.*

Harvest reduces alfalfa root weight

INCREASE in the weight of alfalfa roots during early spring was 86 percent. But within a week after the first hay harvest, the roots lost nearly all of their weight gain, giving up nutrient reserves to new leaves and stems.

These observations from a field study are being used to refine a computerized body of knowledge on responses of alfalfa to environmental conditions. The computer programing, designed by ARS and Purdue University scientists, provides timely management tips for farmers. The programing is also a teaching aid in crop physiology courses and serves as a conceptual framework for new research on increasing hay production.

ARS agronomist Robert G. May (Room 2–308, Lilly Hall of Life Sciences Bldg., Purdue University, West Lafayette, IN 47907), found that after the first hay harvest, root weight losses were less with each succeeding harvest during the season, and periods of weight recovery became shorter each time. As the season progressed, new growth was started more rapidly because of more stubble with less dependence on root reserves for this new growth.

By late September, roots in the top 80 inches of soil increased in weight to about 37 ounces per square yard of field plot—nearly 3½ times their weight in early March. During the March-to-September period, the amount of roots in the top 35 inches of soil increased from 77 percent to 88 percent of the total root mass.—*G.B.H.*

When reporting research involving pesticides, this magazine does not imply that pesticide uses discussed have been registered. Registration is necessary before recommendation. Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if not handled or applied properly. Use all pesticides selectively and carefully.

U. S. GOVERNMENT PRINTING OFFICE : 1977 O - 226-235